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Patentanmeldung Nr. Patent application No. Demande de brevet n°

03025826.3

PRIORITY DOCUMENT
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R C van Dijk

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SUEDE

Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

Method and system for data transmission

In Anspruch genommene Priorität(en) / Priority(ies) claimed /Priorité(s) revendiquée(s)
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Title: METHOD AND SYSTEM FOR DATA TRANSMISSION

FIELD OF INVENTION

The present invention relates to a method and system for data transmission between a server and a client. More in detail, the invention relates to a method and system comprising several physical links for said data transmission wherein the selection of physical links is optimized. The invention also relates to software for executing the method.

BACKGROUND ART

Data transmission between various computer devices is taking place all the time. Such devices may be interconnected by a single link used for all data transmission. A common example is a cable connecting a computer device to a printer via a serial or parallel port. Various protocols for the data transfer exist.

In a system comprising a server sub-system and a client sub-system, a user in the client sub-system may want to use a service in the server sub-system. A logical channel is established for data communication in both directions.

The logical channel is embodied or transmitted by a physical link. Several logical channels may share a common physical link. A logical channel may also be transmitted using several physical links.

A physical link may be any means that is able to establish a physical connection that may transmit data between two devices. The physical link may be interfaced to the client and server in different ways.

A protocol may be used for the exchange of data between the two devices. Often, the data is gathered in packets, having a predetermined size and order of data items. Normally, a packet contains data related to one logical channel.

A transport service member in each computer device may be arranged for handling the packets of data and for the sending and the reception thereof. The transport service may comprise a multiplexer for directing the packets to and from all services in the server and users in the client that may use the actual physical links.

There is required some type of decision means for deciding on which physical link a specific data packet should be transmitted. This may be done by an algorithm that decides on which physical link the data packet should be sent. The algorithm controls the multiplexers.

The algorithm may be more or less elaborate depending on the type of physical link. One simple approach is to use the next physical link that is idle. Else, a specific data packet type is always sent on a specific physical link. Another approach is to determine the traffic intensity and to use the physical link that has the least traffic, gives the lowest cost, highest speed or lowest latency, etc. This is a static configuration.

Each physical link has a specific bandwidth, that may be constant or may be dependent on surrounding conditions. For example, a coaxial cable link has a bandwidth which is dependent on the length of the cable. A radio frequency communications adapter may have a bandwidth dependent on the transmission properties prevailing at the time of transmission.

In certain situations it is required that the response time or latency is sufficient for a given type of data transmission. This is specifically important in real-time transfer of data where the response time must be guaranteed. In order to guarantee the transmission latency, an unnecessarily high bandwidth transmission channel may be implemented. This is an expensive solution which also consumes excessive power.

In a handheld device, such as a mobile telephone or a PDA (personal digital assistant) both cost and high power consumption are negative factors.

Japanese Patent Abstract No. 2002-208934 discloses a communication system in which the header of data is provided with a field for priority and priority is placed on an event communication for communication control over a bulk communication for data transfer. In the communication between logic units, link numbers are used to indicate logical correlation. In the communication, channel numbers are used to discriminate between communication paths, thereby shortening the lengths of headers. When data is transmitted having frequency exceeding the allocated band, the priority is set to be the lowest level. When the information is divided into a plurality of data to be transmitted in the communication, an initial priority is set to be low, and a second and subsequent priorities are enhanced to continuously transmit the data. When the data is re-transmitted, the priority is enhanced.

US 2002/0186701 A1 discloses a telecommunication switching system employing multiprotocol routing optimization which utilizes predetermined and measured parameters in accordance with a set of user priorities in determining the selection of a telecommunication path to be utilized for transmitting a data file to a remote destination. Telecommunication may take place over several alternative paths such as over a high speed digital link via a T1 interface, a local area network LAN, a wide area network WAN, a telephone line or a wireless communication network. US 2002/0186701 A1 discloses the use of an algorithm for deciding the relevant path for transmission of data, depending on a number of predetermined parameters, such as maximum available bandwidth, reliability, economy, availability and security, and a number of dynamic parameters, such as operational state of a path, datasize, latency, time and available bandwidth at time of file transfer. The person using the device may customize the relative weights given to each variable and even force the algorithm to ignore certain parameters.

However, if the receiver is occupied with a task or if there are other restrictions on the receiver side, the system of US 2002/0186701 A1 is unable to resolve which is the best path for transfer of the data. Moreover, if several data transmissions should take place at the same time, the algorithm of US 2002/0186701 A1 is unable to determine the best path.

DISCLOSURE OF INVENTION

However, in a handheld unit such as a PDA or a mobile telephone, the services of the server may be requested by different users in different circumstances. The server has no knowledge of the user of the client or the properties of the user to receive the data packets.

Consequently, the inventor has tried a new approach. The client has full knowledge over the data flow in and out to each user of the client. Thus, the client is in a good position to determine which physical link that should be used for the data transfer.

Thus, according to the invention, the client decides which physical link a server should use for transmitting a service to a user of the client. In this way, conditions at the receiver side may be taken into account for the selection of the physical link to be used for the data transfer.

When the client decides which physical link that should be used, the server may be constructed as a platform that may be used by different clients and still have the same configuration. Thus, the construction of the server can be modularized, which makes the complete system less expensive and more easily adaptable to different conditions and different clients. Moreover, the software of the server can be implemented in the same way irrespectively of how the client is embodied.

Thus, a first object of the invention is to provide a method and system for data transfer, wherein conditions at the receiver side may influence the decision on which physical link to use.

A second object of the invention is to provide a method and a system for data transfer, in which several data transmissions may take place at the same time and a transmission path is properly selected.

A third object of the invention is to provide a method and a system that makes it possible to arrange the server in a modularized manner so that the same server may be used together with clients having different constructions, requirements and software.

These objects are met by a method and system as set forth in the appended patent claims.

In a first aspect, the invention comprises a system for transmission of data between a client and a server over at least two physical links. According to the invention, a decision means is controlled by the client for selecting at least one of said physical links for transmission of said data. The transmission may be bidirectional. Each physical link may be provided with an identification number and said decision means being arranged in order for the client to initiate said physical link indicating said identification number for opening the service. Since the decision means is controlled by the client that knows the data transmission to and from the user of the client, the server may be adapted to the specific client and the same server may be used for different clients.

The physical links may be separate and have at least one component specific for each physical link. Each physical link may comprise a universal asynchronous receiver-transmitter. The physical link may comprise at least one component selected from the group comprising short cables, PCB wires, a twinned-pair cable, a coaxial cable, a Bluetooth communication channel, and a serial port. By arranging the physical link as mentioned above, the transmission may take place as required.

The client may comprise a processor and an associated memory. The processor may be adapted to determine properties of each link and store such

properties in the client memory. The server may comprise a processor and an associated memory, whereby the processor may be adapted to receive an identification number for each physical link from said client and store said identification number in said server memory. In this way, the client and the server may identify a physical link by an identification number stored in the memory.

Each physical link may be identical with all physical links, and may comprise a cable. In this way, the selection process between the physical links is facilitated, since they all have the same properties and may be selected arbitrarily.

The server or the client may be embodied in a device selected from the group comprising a mobile radio terminal, a mobile telephone, a pager, a communicator, an electronic organizer, a PDA (Personal Digital Assistent), a smartphone, a computer, a multimedia player, and a MP3 player.

In a second aspect, the invention comprises a method for transmission of data between a client and a server over at least two physical links. According to the invention, the method comprises that said client selects at least one of said physical links for transmission of said data. The transmission may be bidirectional. The method may also comprise requesting a service from the server by a user of a client, and sending a data packet by said client to said server indicating the physical link that said service should be provided over. In this way, the physical link selected for a service is requested by the client having knowledge of the data flow to and from the users of the client.

In a third aspect of the invention, the method comprises initiating transmission of data between a client and a server over at least two physical links, determination of properties of available physical links by said client, sending data by said client to said server including identification numbers for said physical links, and storing said identification numbers in a

memory of said server. In this way, the server and client are setup so that future requests for services may be handled properly.

In a fourth aspect of the invention, there is provided a method for transmission of data between a client and a server over at least two physical links. According to the invention, the method comprises that the server receives data from a client comprising a request for a service and identification data for at least one physical link for transmission of said service; followed by transmission of said service over a physical link corresponding to said identification data. The identification data may comprise identification numbers for at least one physical link; whereupon the server is looking up a physical link in a memory corresponding to said identification number and selecting said physical link for said transmission. In this way, the server is controlled by the client and reacts on the instructions received from the client.

In a fifth aspect of the invention, there is provided a computer program arranged on a tangible medium for performing at least one of the method steps defined herein above. More specifically, the computer program product is embodied on a computer readable medium, comprising computer readable instructions for carrying out the method defined herein above when run by an electronic device having digital computer capabilities.

In a sixth aspect of the invention, there is provided an electronic device having digital computer capabilities arranged to run the computer program defined herein above.

In a seventh aspect of the invention, there is provided the use of a system defined herein above in a handheld device. The handheld device is selected from the group comprising a mobile radio terminal, a mobile telephone, a pager, a communicator, an electronic organizer, a PDA (Personal Digital Assistent), a

smartphone, a computer, a multimedia player, and a MP3 player.

It should be emphasized that the term "comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects, features and advantages of the invention will appear from the detailed description of embodiments given below with reference to the accompanying drawings in which:

Fig. 1 is a schematic view of a mobile telephone in which the present invention may be used;

Fig. 2 is a schematic view of the mobile telephone of Fig. 1, wherein the concept of server and client is exemplified;

Fig. 3 is a schematic block scheme over a system according to the present invention;

Fig. 4 is a schematic block scheme over an alternative system according to the present invention;

Fig. 5 is a flow scheme of an initiation method for the setup of the system of the invention.

Fig. 6 is a flow scheme of a selection method for the system of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

Fig. 1 discloses a mobile terminal 1 comprising a man machine interface for operating the terminal. The man machine interface may comprise a microphone 10, a loudspeaker or an earphone 11, a keypad 12, and a display 13. Furthermore, the mobile terminal 1 may comprise communication means for communicating with a network and with other electronic equipment, such as a computer, a personal digital assistant, a communicator, an external multimedia player, such as a MP3 player, a PDA or a

smartphone. The communication means may comprise a first antenna 14 for communicating with a communication network, such as a telecommunication network according to e.g. the GSM/GPRS, the UMTS, such as according to EDGE or WCDMA technology, or the cdma2000 standard, over a wireless communication link. The mobile terminal may also comprise a short-range supplementary antenna 15 for communicating with a wireless local area network, such as according to Bluetooth® technology, or a means 16 for establishing an infrared (IR) connection with another electronic device. The antennas may be external as shown or arranged inside the cover invisible from the outside. The mobile terminal 1 may also comprise an accessory connector 17, to which an external device, such as an MP3 player or a digital camera, may be connected either directly or through a serial cable. The communication means also comprises various circuitries for communication using communication interfaces, such as modulators, demodulators, amplifiers, transmitters, receivers, etc.

Reference is made to a mobile terminal or mobile telephone 1 in the following. However, the invention is not limited to a mobile terminal, but can be incorporated into any electronic equipment. Such electronic equipment may comprise a mobile radio terminal, a mobile telephone, a pager, a communicator, an electronic organizer, a PDA (Personal Digital Assistent), a smartphone, a computer, or a multimedia player, such as a MP3 player. Such equipment may be handheld devices.

The mobile telephone of Fig. 1 may comprise a main processing unit 18a as shown in Fig. 2. The processing unit 18a may be connected to an ASIC 18b via several physical links 18c, 18d, 18e, 18f. Furthermore, the processing unit 18a may be connected to the accessory connector 17 via three physical links 19b, 19c, 19d. An add-on device 19a may be connected to the accessory connector 17 via a connector 19e and three physical links

19f, 19g, 19h that connects to a processing unit 19i in the add-on device 19a.

In the mobile telephone shown in Fig. 2, the processing unit 18a may be a server delivering services to ASIC 18b and add-on device 19a. Such services may be SMS. Thus, ASIC 18b and add-on device 19a are clients.

Moreover, ASIC 18b may be a server, for example a video ASIC connected to an integrated video sensor chip for providing images. Processing unit 18a is then a client requesting services from ASIC 18b.

The same is true for add-on device 19a, that may be a memory comprising MP3 files that should be played by the processing unit 18a. In this case add-on device 19a is a server and the processing unit 18a is a client.

There may be several clients connected to the same server and a client may be connected to several servers.

Fig. 3 is a schematic block diagram of a system according to the invention. The system comprises a server 20 and a client 50 interconnected by several physical links, three links 41, 42, 43 being shown in Fig. 3.

The server 20 comprises several services 21, 22, 23, 24, 25, 26, 27, each connected to a transport service unit 28. The transport service unit 28 comprises a multiplexer 29, which may be embodied in software, and three UART 30, 31, 32 each connected to a physical link 41, 42, 43. The services 21 to 27 may comprise services such as: message services such as SMS (short message service), EMS (enhanced message service), MMS (multimedia messaging systems); file system access, such as MP3 files or image files; call control services; data services for example related to background services, such as checking for new e-mails; simple control signaling, such as volume control settings, LED control, vibrator control; camera control; Video Telephony; Dial-up Networking, etc. Moreover, the server comprises a processor 33 and an associated memory 34.

The client 50 comprises several users 51, 52, 53, 54, 55 each connected to a transport service unit 56. The

transport service unit 56 comprises a multiplexer 57 and three UART 58, 59, 60 each connected to a physical link 41, 42, 43. Moreover, the client comprises a processor 61 and an associated memory 62.

In handheld devices, such as a mobile telephone or a PDA, the server may comprise the main processor 18a of the telephone or the PDA that normally executes applications, which may be services.

However, add-on units, such as a digital camera or a global positioning system unit, normally includes a processor that executes applications on the add-on unit. The processor of the add-on unit may want to communicate with the processor of the handheld device.

More generally, application chips may be included in the handheld devices. Such application chips may want to be able to use the services of the handheld device. Examples of such application chips are an MP3-player or a Video Telephone unit. Moreover, the handheld device may include one or several ASIC 18b for performing specific tasks, such as receiving and conditioning data from a video sensor chip. Such an ASIC may comprise a processor that wants to take advantage of the service executing on the main processor of the handheld device.

Such add-on units, application chips and ASIC may be clients in the sense of the present invention. The applications that are executed by the processor of the clients may be users in the sense of the present invention. Generally, any application or software that requests a service is a user.

The application that constitutes a user may be initiated automatically, for example at power-up or at regular time intervals, or may be initiated by a person using the device. The application may also be initiated by external devices, for example a light sensor indicating that the device is exposed to light.

The multiplexer of the server and/or the client may be implemented in software and/or hardware.

A physical link is any means able to transmit data from one device to another device. By a physical link is meant a link that includes at least one component that is physically separate from a component of another physical link. For example, each link 41, 42, 43 includes a server UART 30, 31, 32, a cable 41, 42, 43 and a client UART 58, 59, 60. These three components are physically separate for each physical link. However, the three physical links share a multiplexer at each end.

The physical link may be any one of: short cables, PCB wires, a coaxial cable, a twinned-pair cable, a Bluetooth communication channel, a serial port, etc. The physical link may also be a high-speed digital link.

Each physical link has properties that are specific for this physical link and are not influenced by properties of other physical links. One example is that the bandwidth is separate for each physical link. Each physical link may also have properties that are influenced by other physical links, such as the speed of the multiplexer.

The physical link may be interfaced to the respective devices, server and client, in different manners, such as by a universal asynchronous receiver-transmitter UART as shown in the drawings. Other types of interfaces works equally well, such SPI (Serial Peripheral Interface), I^2S, I^2C, etc.

Fig. 4 discloses an alternative system according to the invention. The same reference numbers have been used for the same components as in Fig. 3. The server is arranged in the same manner as in Fig. 3. However, the client has another user 63, that is directly connected to physical link 43. Such a user may be a video telephone user that always needs maximum bandwidth and thus is hardware dedicated to the third physical link 43. Moreover, the multiplexer 57 cannot connect to the third physical link 43. Application 63 may include a UART for communication with UART 31 of the server. Thus, data packet reception may take place as fast as possible with

minimum latency and more or less independently of the other users of the client.

In the prior art, normally the server decided over which physical link data related to the service should be transmitted. However, the server normally does not know the maximum latency that is acceptable by a user for a given service. Thus, the server is unable to decide how to distribute the data from the different services that have been activated by the user(-s) over the available physical links.

The solution to the problem is to allow the user or the client to determine over which physical link data packets relevant for a specific service requested from the server should be transmitted. The client can then reconfigure the transmission links if it is concluded that the latency is unacceptable. Thus, at least part of the operation of the server is controlled by the user. The user requests the physical link(-s) for transmission.

Thus, SMS and IP data related to background operations could share the same physical link, since such data has a relative low bandwidth requirement. Such background operations may be checking for new e-mails or a command for control of the volume of an audio output.

However, a streaming session showing a video clip and a second IP data connection to download an MP3-file might not be able to share a single physical link, since the quality of the video stream may be affected by the long IP packets of the MP3-file. A video telephony data stream would normally need to be placed on a separate physical link.

It is mentioned that the data transfer between the server and client may be bidirectional, although the main data transfer may be from the server to the client.

In order for the client to be able to indicate which physical link that should be used, an identification of each link has to be established. According to the invention, the client numbers each physical link by initially sending a data packet to the server via each of

the physical links. Each packet contains a unique identification number that the client will use to identify the physical link at a later stage. The server puts these identification numbers in a memory 34 for subsequent use.

When requesting a service, the client indicates on which physical link(-s) all the data packets with data for this service should be put on by referring to the identification number.

A method indicated in Fig. 5 may be used at the setup of the system. If the client and server are hardware connected without removal possibilities, such as by PCB wires, such setup method may be performed at the initial start up of the system. The identification numbers may then be stored in a parameter memory of the server and the client. However, if the client is removably connected to the server, such as by connectors 17, 19e, the method is performed each time the client is connected.

As indicated in Fig. 5, at the setup 70 of the system, the client determines in step 71 how many physical links that are present and properties for such links. This data is stored in step 72 in a memory 62 of the client. In step 73, the client forms a data packet for each physical link. Each data packet contains a unique identification number that the client will use to identify the physical link. The data packets are sent to the server in step 74 on each physical link. The server receives such data packets and extracts the identification numbers and relates them to each physical link and stores them in step 75 in a memory 34 of the server.

The properties to be determined in step 71 may include one or several of the following properties: type of link, maximum available bandwidth, reliability, economy, availability, and security.

The properties may be determined by electronic circuitry in the client or by software in the client. For

example, the latency of the physical link may be determined via a "ping" action, well known to the skilled person.

The properties of the physical links may alternatively be entered into the system via input means, such as a keyboard, a touch-sensitive pad, or a mouse device, or be included in the software of the user application.

It is mentioned that the system may include physical links that are normally non-active. Such surplus physical links may be normally deactivated for saving power. Such surplus physical links may be activated if they are needed.

The use of the system is exemplified in the flow scheme of Fig. 6. The start 80 may be a request from a user in the client to access a specific service in the server. The client processor determines in step 81 the required properties for the service. If the service is a video telephone service, a dedicated physical link with high bandwidth or a dedicated physical link may be required while a SMS service may be performed on almost any physical link and may also share a physical link with other services.

In step 82, the system determines if a physical link with the desired properties is available. If yes, that physical link is dedicated to the service for the user. If no, in step 83, the client processor tries to free up a physical link by any means, such as combining concurrent activities, or opening of a new surplus link that has been non-active, or moving a service to another physical link. The action then returns from step 83 to before step 82.

In step 84 a specific physical link having an identification number is dedicated to the requested service. The client processor in step 85 forms a data packet including the physical link identification number and a request for a specific service over the dedicated physical link. The data packet is sent to the server.

In step 86, the server responds to said request by looking up the relevant physical link in its memory and establishing a communication path from said service to said physical link.

Herein above, the invention has been described with reference to several specific embodiments shown on the drawings. A skilled person may become aware of other means and combinations that occur to him reading the specification. Such combinations are intended to be included within the scope of the invention. The invention is only limited by the appended patent claims.

PATENT CLAIMS

1. A system for transmission of data between a client and a server over at least two physical links, **characterized** by

a decision means controlled by the client for selecting at least one of said physical links for transmission of said data.

2. The system of claim 1, **characterized** in that each physical link is provided with an identification number and said decision means being arranged in order for the client to initiate said physical link indicating said identification number for opening the service.

3. The system of claim 1 or 2, **characterized** in that said transmission of data between a client and a server is bidirectional.

4. The system of claim 1, 2 or 3, **characterized** in that said physical links are separate and have at least one component specific for each physical link.

5. The system of claim 4, **characterized** in that said physical link comprises a universal asynchronous receiver-transmitter.

6. The system of claim 4 or 5, **characterized** in that said physical link comprises at least one component selected from the group comprising short cables, PCB wires, a twinned-pair cable, a coaxial cable, a Bluetooth communication channel, and a serial port.

7. The system of any one of the preceding claims, **characterized** in that said client comprises a processor and an associated memory, whereby the processor is adapted to determine properties of each link and store such properties in said client memory.

8. The system of claim 7, **characterized** in that said server comprises a processor and an associated memory, whereby the processor is adapted to receive an identification number for each physical link from said client and store said identification number in said server memory.

9. The system of any of the preceding claims, **characterized** in that each physical link is identical with all physical links.

10. The system of claim 9, **characterized** in that each physical link comprises a cable.

11. The system of any one of claims 1 to 10, **characterized** in that at least one of said server and said client is embodied in a device selected from the group comprising: a mobile radio terminal, a mobile telephone, a pager, a communicator, an electronic organizer, a PDA (Personal Digital Assistent), a smartphone, a computer, a multimedia player, and a MP3 player.

12. A method for transmission of data between a client and a server over at least two physical links, **characterized** by

said client selecting at least one of said physical links for transmission of said data.

13. The method of claim 12, **characterized** by

requesting a service from the server by a user of a client, and

sending a data packet by said client to said server indicating the physical link that said service should be provided over.

14. A method of initiating transmission of data between a client and a server over at least two physical links, **characterized** by

determination of properties of available physical links by said client,

sending data by said client to said server including identification numbers for said physical links, and

storing said identification numbers in a memory of said server.

15. A method for transmission of data between a client and a server over at least two physical links, **characterized** by

the server receiving data from a client comprising a request for a service and identification data for at

least one physical link for transmission of said service; and

transmission of said service over a physical link corresponding to said identification data.

16. The method of claim 15, **characterized** by

said identification data comprising identification numbers for at least one physical link; and

said server looking up a physical link in a memory corresponding to said identification number and selecting said physical link to said transmission.

17. The method of any one of claims 12 to 16, **characterized** in that said transmission is bidirectional.

18. The method of any one of claims 12 to 17, **characterized** in that at least one of said server and said client is embodied in a device selected from the group comprising: a mobile radio terminal, a mobile telephone, a pager, a communicator, an electronic organizer, a PDA (Personal Digital Assistent), a smartphone, a computer, a multimedia player, and a MP3 player.

19. A computer program arranged on a tangible medium for performing at least one of the method steps defined in any one of claims 12 to 18.

20. The computer program product embodied on a computer readable medium according to claim 19, comprising computer readable instructions for carrying out the method according to any of the claims 12 to 18 when run by an electronic device having digital computer capabilities.

21. An electronic device having digital computer capabilities arranged to run the computer program according to claim 19 or 20.

22. Use of a system according to any one of claims 1 to 11 in a handheld device.

23. The use of claim 22, in which the handheld device is selected from the group comprising: a mobile radio terminal, a mobile telephone, a pager, a communicator, an electronic organizer, a PDA (Personal

Digital Assistent), a smartphone, a computer, a multimedia player, and a MP3 player.

ABSTRACT

Method and system for the transmission of data between a client and a server over at least two physical links. The client decides which physical link that should be used for the transmission of data when a user of the client requests a service from the server. Disclosed is also a computer program, an electronic device and the use of the system.

(Figure to be published: Fig. 3)

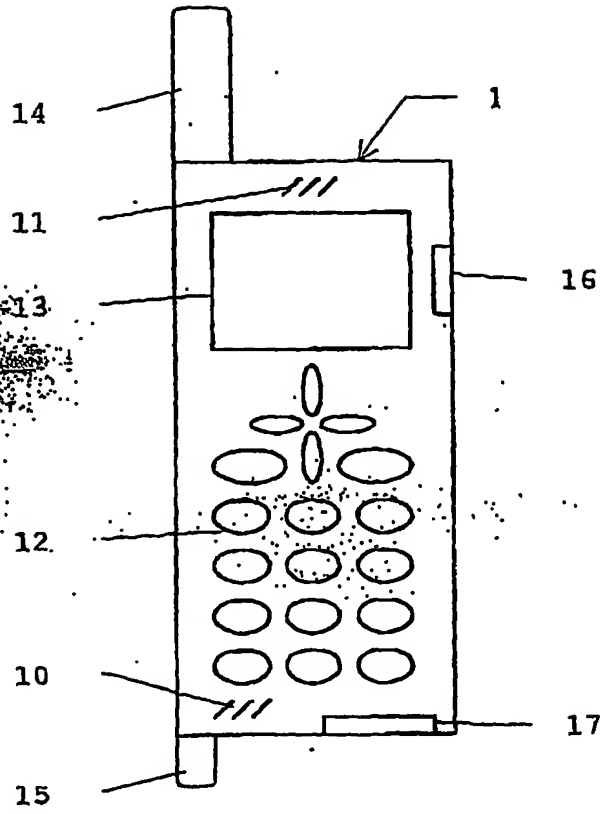

Fig. 1

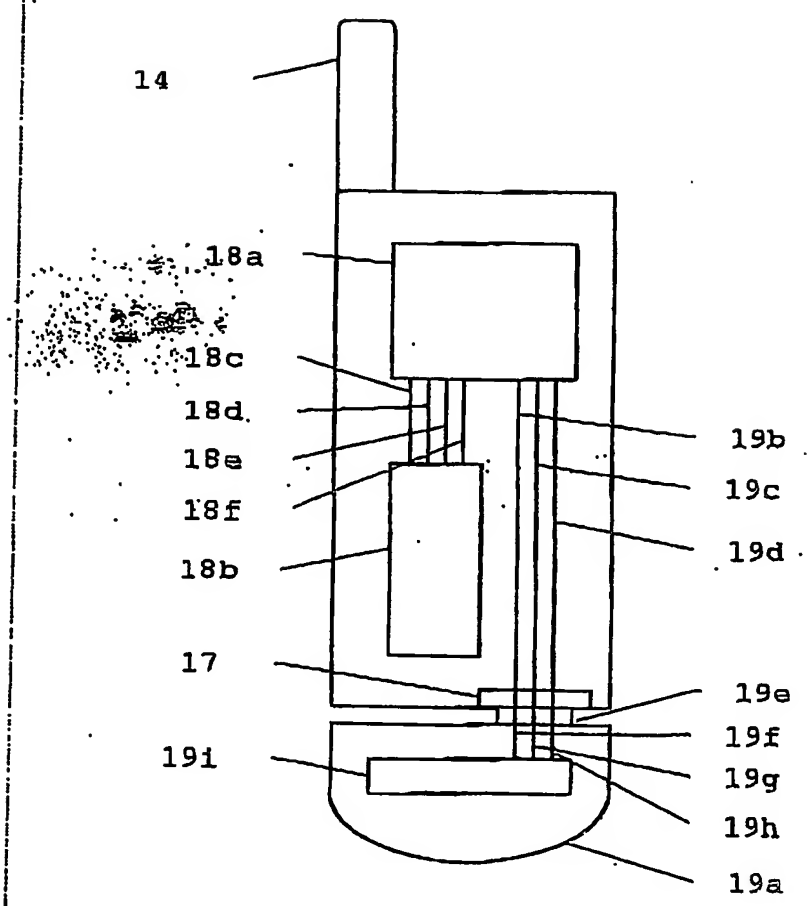

Fig. 2

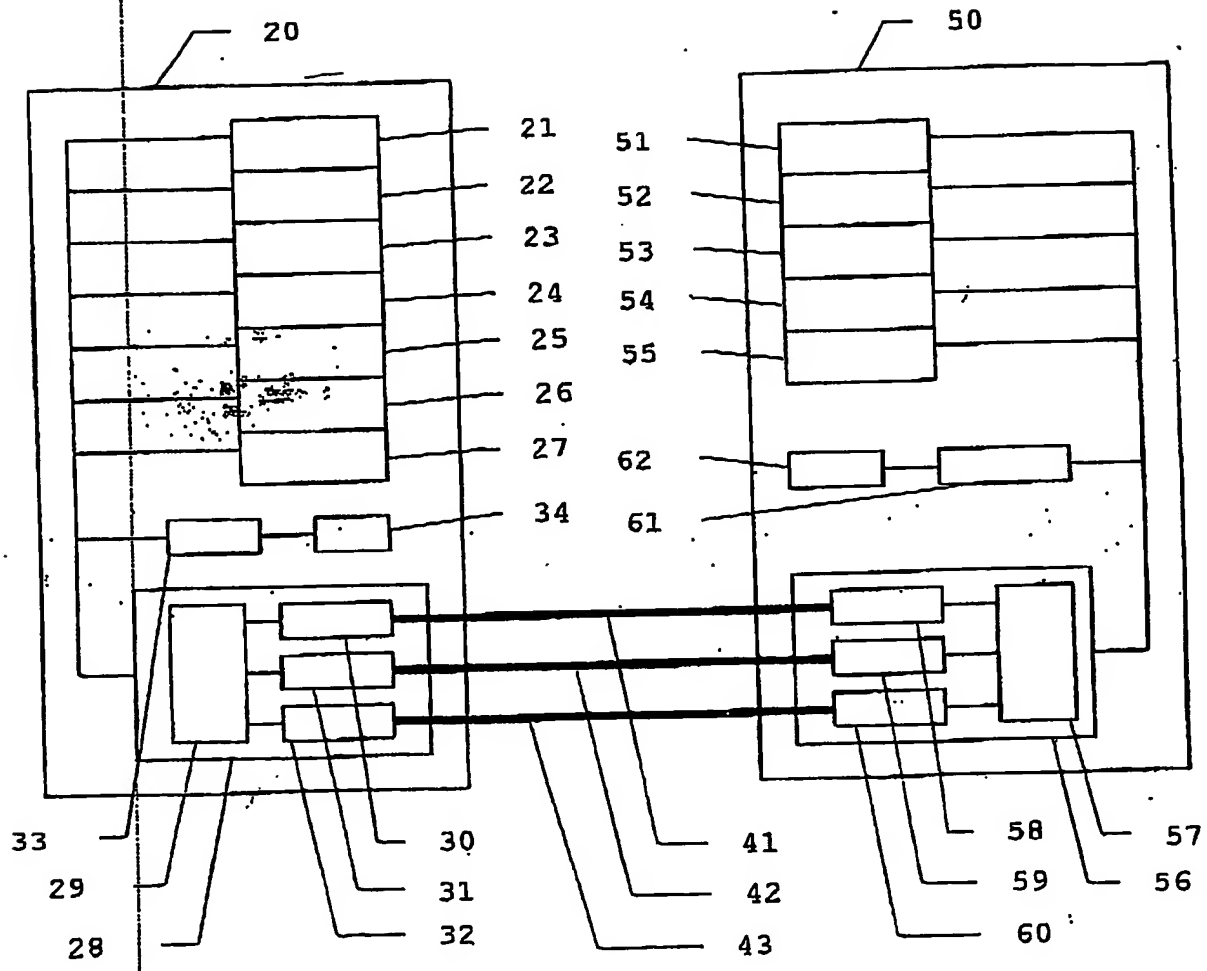
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Fig. 3

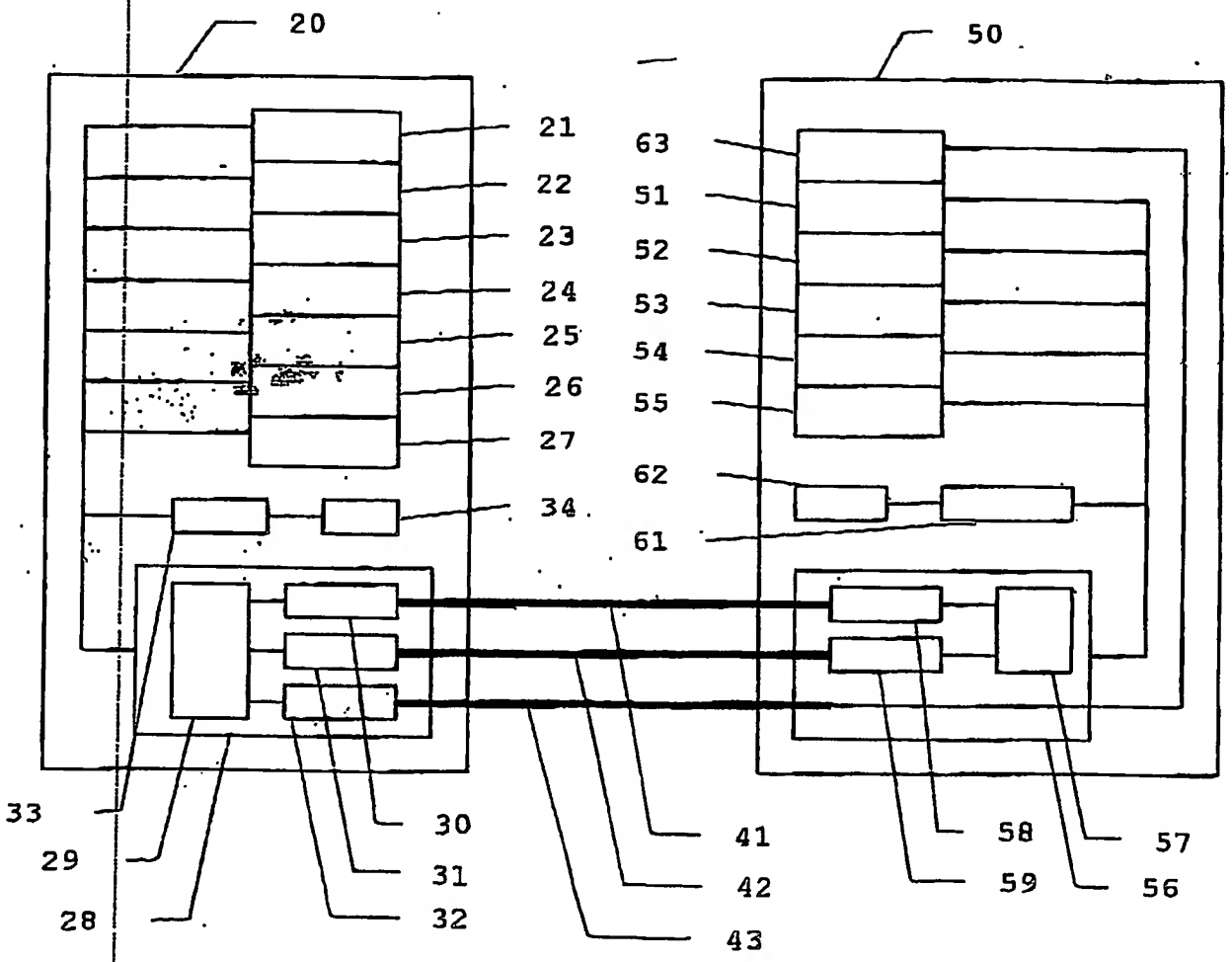
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Fig. 4

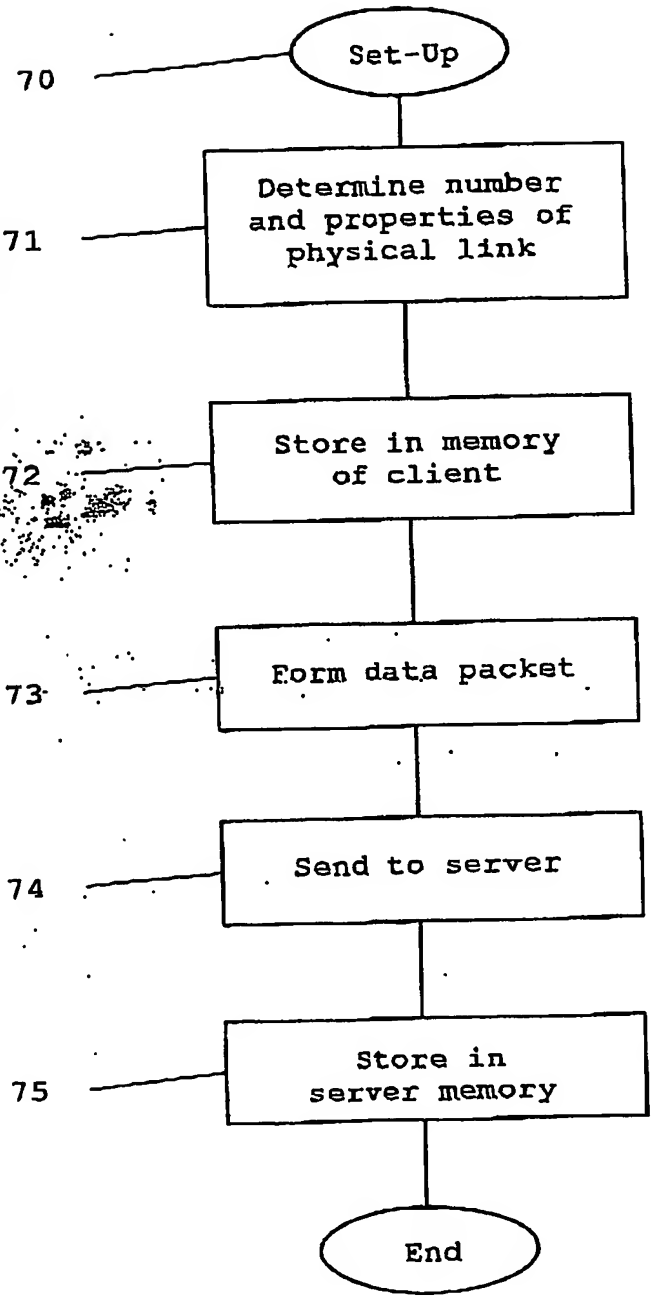
70
Set-Up
71
Determine number and properties of physical link
72
Store in memory of client
73
Form data packet
74
Send to server
75
Store in server memory
End

Fig. 5

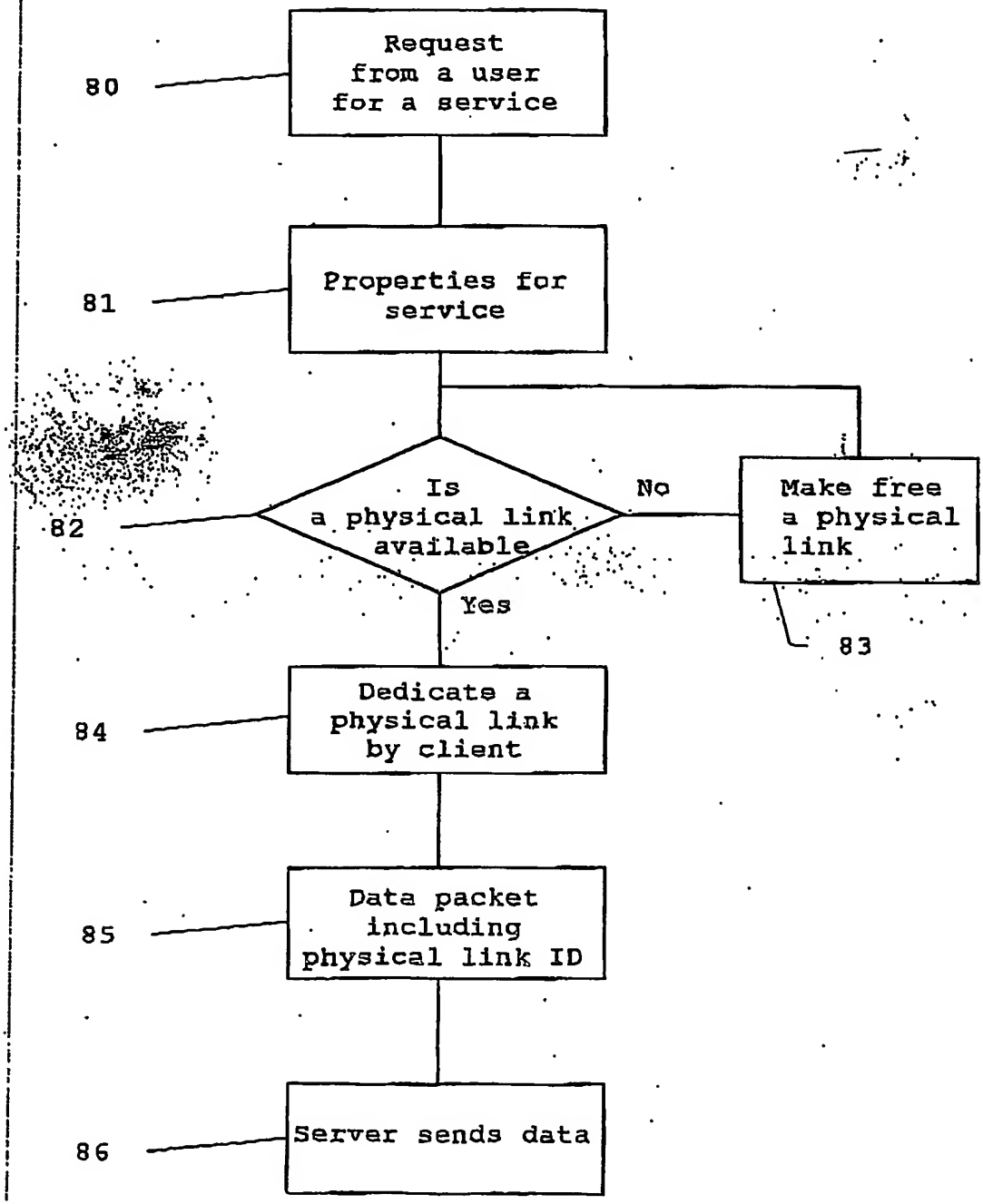
Request from a user for a service
80
Properties for service
81
Is a physical link available
82
No
Make free a physical link
83
Yes
Dedicate a physical link by client
84
Data packet including physical link ID
85
Server sends data
86

Fig. 6

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